

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2004/003727

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F02M21/02 F02M51/06 F02M61/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F02M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|--|-----------------------|
| X | US 5 924 674 A (FUCHS HEINZ ET AL) 20 July 1999 (1999-07-20) abstract column 4, line 8 - column 4, line 17; figure 1 | 1-15 |
| X | EP 0 026 060 A (LUCAS IND PLC) 1 April 1981 (1981-04-01) page 4, line 18 - page 4, line 23; figure 1 | 1-15 |
| X | PATENT ABSTRACTS OF JAPAN vol. 013, no. 593 (M-914), 27 December 1989 (1989-12-27) & JP 01 249960 A (JAPAN ELECTRON CONTROL SYST CO LTD), 5 October 1989 (1989-10-05) abstract | 1-15 |

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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
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- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *G* document member of the same patent family

Date of the actual completion of the international search

12 November 2004

Date of mailing of the international search report

24. 11. 2004

Name and mailing address of the ISA

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| C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT | | |
|--|---|-----------------------|
| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
| X | WO 88/04727 A (LUCAS IND PLC) 30 June 1988 (1988-06-30) page 5, line 4 - page 5, line 10; figure 2 | 1-15 |
| X | WO 99/18345 A (CAMPBELL BILL ROSS ;GAS INJECTION TECHNOLOGIES PTY (AU)) 15 April 1999 (1999-04-15) abstract; figure 1 | 1-15 |
| X | EP 1 231 378 A (DELPHI TECH INC) 14 August 2002 (2002-08-14) column 3, line 48 - column 3, line 49; figure 1 | 1-15 |
| X | GB 2 178 483 A (LUCAS IND PLC) 11 February 1987 (1987-02-11) page 1, line 84 - page 1, line 86; figures 2,3 | 1-15 |
| X | US 4 156 506 A (LOCKE ALAN W ET AL) 29 May 1979 (1979-05-29) column 3, line 18 - column 3, line 20; figure 6 | 1-15 |
| X | EP 0 491 404 A (JAPAN ELECTRONIC CONTROL SYST) 24 June 1992 (1992-06-24) figure 2 | 1-15 |
| X | EP 1 114 929 A (RENAULT) 11 July 2001 (2001-07-11) figure 1 | 1-15 |
| X | US 6 311 901 B1 (HALL BRYAN ET AL) 6 November 2001 (2001-11-06) figure 5 | 16-20 |
| X | US 5 685 485 A (KAPPEL ANDREAS ET AL) 11 November 1997 (1997-11-11) column 3, line 65 - column 4, line 4; figure 2 | 16-20 |
| X | US 2002/074431 A1 (REN WEI-MIN ET AL) 20 June 2002 (2002-06-20) page 3, paragraph 28; figure 2 | 16-20 |
| P,X | EP 1 398 497 A (DENSO CORP) 17 March 2004 (2004-03-17) figures 2,5 | 16-20 |
| X | US 6 422 198 B1 (FOURNIER STEPHANE ET AL) 23 July 2002 (2002-07-23) column 7, line 13 - column 7, line 15; figures 3,7 | 16-20 |
| | -/-- | |

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|--|-----------------------|
| X | US 2002/030124 A1 (IMOehl WILLIAM JAMES) 14 March 2002 (2002-03-14) page 3, paragraphs 34,36,40; figure 5 ----- | 16-20 |
| P,X | EP 1 375 903 A (SIEMENS VDO AUTOMOTIVE CORP) 2 January 2004 (2004-01-02) figures 2a,2b ----- | 16,17, 19,20 |

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Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; It is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-15

Claims 1-15 define special technical features relating to a discoidal valve member controlling the flow of gaseous fuel from a fuel injector in an internal combustion engine.

2. claims: 16-20

Claims 16-20 define special technical features relating to the injection orifice size and shape of a fuel injector of gaseous fuel for an internal combustion engine. Although claims 16-20 are dependent on claim 1, claim 1 is not new, and therefore the application lacks unity a posteriori.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP2004/003727

| Patent document cited in search report | | Publication date | Patent family member(s) | Publication date |
|---|----|---------------------|--|--|
| US 5924674 | A | 20-07-1999 | DE 19523915 A1 BR 9606453 A CN 1157030 A , B WO 9702433 A1 DE 59610001 D1 EP 0778924 A1 JP 10505403 T US 6131880 A | 02-01-1997 23-12-1997 13-08-1997 23-01-1997 30-01-2003 18-06-1997 26-05-1998 17-10-2000 |
| EP 0026060 | A | 01-04-1981 | EP 0026060 A1 JP 56064149 A | 01-04-1981 01-06-1981 |
| JP 01249960 | A | 05-10-1989 | JP 2584276 B2 | 26-02-1997 |
| WO 8804727 | A | 30-06-1988 | EP 0294406 A1 WO 8804727 A1 JP 1501646 T | 14-12-1988 30-06-1988 08-06-1989 |
| WO 9918345 | A | 15-04-1999 | AU 749457 B2 AU 9424498 A WO 9918345 A1 CA 2305244 A1 EP 1021652 A1 | 27-06-2002 27-04-1999 15-04-1999 15-04-1999 26-07-2000 |
| EP 1231378 | A | 14-08-2002 | US 2003111559 A1 EP 1231378 A2 | 19-06-2003 14-08-2002 |
| GB 2178483 | A | 11-02-1987 | NONE | |
| US 4156506 | A | 29-05-1979 | GB 1599525 A DE 2812739 A1 ES 468271 A1 FR 2384956 A1 IT 1093613 B JP 53120017 A | 07-10-1981 28-09-1978 16-09-1979 20-10-1978 19-07-1985 20-10-1978 |
| EP 0491404 | A | 24-06-1992 | JP 2518031 Y2 JP 4089853 U EP 0491404 A1 US 5178332 A | 20-11-1996 05-08-1992 24-06-1992 12-01-1993 |
| EP 1114929 | A | 11-07-2001 | FR 2803362 A1 EP 1114929 A1 | 06-07-2001 11-07-2001 |
| US 6311901 | B1 | 06-11-2001 | AU 4665000 A EP 1175558 A1 EP 1175559 A1 EP 1175560 A1 EP 1173672 A1 JP 2002543330 T WO 0065225 A1 WO 0065226 A1 WO 0065227 A1 WO 0065228 A1 US 6334434 B1 US 2002050536 A1 US 2002030124 A1 | 10-11-2000 30-01-2002 30-01-2002 30-01-2002 23-01-2002 17-12-2002 02-11-2000 02-11-2000 02-11-2000 02-11-2000 01-01-2002 02-05-2002 14-03-2002 |

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP2004/003727

| Patent document cited in search report | | Publication date | Patent family member(s) | Publication date |
|---|----|---------------------|----------------------------|---------------------|
| US 5685485 | A | 11-11-1997 | DE 4409848 A1 | 19-10-1995 |
| | | | DE 59505999 D1 | 01-07-1999 |
| | | | EP 0681873 A1 | 15-11-1995 |
| | | | JP 7256155 A | 09-10-1995 |
| US 2002074431 | A1 | 20-06-2002 | NONE | |
| EP 1398497 | A | 17-03-2004 | JP 2004060519 A | 26-02-2004 |
| | | | JP 2004060521 A | 26-02-2004 |
| | | | JP 2004068788 A | 04-03-2004 |
| | | | EP 1398497 A2 | 17-03-2004 |
| | | | US 2004069873 A1 | 15-04-2004 |
| US 6422198 | B1 | 23-07-2002 | NONE | |
| US 2002030124 | A1 | 14-03-2002 | US 2002050536 A1 | 02-05-2002 |
| | | | AU 4665000 A | 10-11-2000 |
| | | | EP 1175558 A1 | 30-01-2002 |
| | | | EP 1175559 A1 | 30-01-2002 |
| | | | EP 1175560 A1 | 30-01-2002 |
| | | | EP 1173672 A1 | 23-01-2002 |
| | | | JP 2002543330 T | 17-12-2002 |
| | | | WO 0065225 A1 | 02-11-2000 |
| | | | WO 0065226 A1 | 02-11-2000 |
| | | | WO 0065227 A1 | 02-11-2000 |
| | | | WO 0065228 A1 | 02-11-2000 |
| | | | US 6334434 B1 | 01-01-2002 |
| | | | US 6311901 B1 | 06-11-2001 |
| EP 1375903 | A | 02-01-2004 | US 2004000603 A1 | 01-01-2004 |
| | | | EP 1375903 A2 | 02-01-2004 |
| | | | JP 2004156583 A | 03-06-2004 |